Claims

1. A liquid handling system comprising:

a dispensing head

a sample support surface,

a quick-release mounting system capable of releasably securing a cannula array to the dispensing head

the handling system being configured to provide for relative movement between the dispensing head and sample support surface in at least two dimensions.

8. A liquid handling system comprising as defined in claim 1 wherein

the handling system is configured to provide for relative movement between the dispensing head and support surface in three dimensions.

3. A liquid handling system comprising as defined in claim 1 wherein

the dispensing head is movable in three dimensions.

4. A liquid handling system as defined in claim 1 wherein the dispensing head comprises at least one fluid pathway that is selectively pressurizable.

5. A liquid handling system as defined in claim 4 wherein the dispensing head comprises a fluid pathway defined by at least one syringe body capable of aspirating and pressurizing fluid.

6. A liquid handling system as defined in claim 4 wherein the dispensing head comprises a fluid pathway selectively pressurized by an external pressure source.

7. A liquid handling system as defined in claim 1 further comprising a controller configured to provide automated control of the relative movement between the dispensing head and support surface.

8. A liquid handling system as defined in claim 7 wherein the controller controls operation of robotics that move the dispensing head.

9. A liquid handling system as defined in claim 7 wherein the quick-release mounting system is operated automatically under command of the controller.

10. A liquid handling system as defined in claim 1 wherein the quick-release mounting system comprises a releasable clamp.

11. A liquid handling system as defined in claim 10 wherein the releasable clamp is actuated remotely.

12. A liquid handling system as defined in claim 10 wherein the releasable clamp is actuated manually.

13. A liquid handling system as defined in claim 10 wherein the releasable clamp is actuated by pneumatic pressure.

14. A liquid handling system as defined in claim 13 wherein the pneumatic pressure actuates the clamp through a pneumatic solenoid joined to the clamp.

15. A liquid handling system as defined in claim 4 further comprising a cannula array that comprises a plate having a plurality of openings formed therethrough and cannulas extending from one side of the plate at each opening and

the other side of the plate being configured for engagement and communication with the fluid pathway of the dispensing head.

16. A liquid handling system as defined in claim 10 wherein the cannulas are fixedly attached to the plate at each opening.

17. A liquid handling system as defined in claim 10 wherein the clamp is configured to engage the cannula array at least partially around the periphery of the cannula array plate.

18. A liquid handling system as defined in claim 10 wherein the quick-release mounting system further comprises an alignment mechanism having guides to properly locate a cannula array loaded into the system.

19 A liquid handling system as defined in claim 18 wherein the guides of the alignment mechanism further comprise alignment pins and recesses arranged to be engaged with each other when the cannula array is properly aligned.

20. A liquid handling system as defined in claim 19 wherein the alignment pins are spring-loaded.

21. A liquid handling system as defined in claim 10 wherein the quick-release mounting system comprises at least one L-shaped bracket providing slots on the dispensing head arranged to slidably receive the cannula array plate.

22. A liquid handling system as defined in claim 21, wherein the slots of the L-shaped brackets have alignment pins configured to engage alignment recesses formed on the cannula array plate.

23. A liquid handling system as defined in claim 10, further comprising a clamp actuating mechanism and at least one spring and positioned between the clamp and a clamp actuating mechanism to control the amount of clamping force applied to the cannula array by the clamping mechanism.

24. A liquid handling system as defined in claim 15 further comprising a sealing element between each cannula and a fluid pathway of the dispensing head that creates a fluid tight seal when a cannula array is secured to the dispensing head.

25. A liquid handling system as defined in claim 24 wherein the sealing element comprises O-ring gaskets surrounding each opening of the cannula array plate.

26. A liquid handling system as defined in claim 24 wherein the sealing element comprises a sealing mat of resilient material overlying the cannula array plate with openings defined therethrough corresponding to the openings of the array plate.

27. A liquid handling system as defined in claim 24 wherein the sealing element is integrated into a portion of the cannulas.

28. A liquid handling system as defined in claim 27 wherein the cannulas are removably located by the cannula plate and comprise disposable plastic dispensing tips.

29. A liquid handling system as defined in claim 10 wherein the clamp is configured to become aligned with a cannula array by relative movement between the dispensing head and support surface in a single dimension.

30. A liquid handling system as defined in claim 29 further comprising a cannula array storage area on the support surface to which is transferred cannula arrays from the dispensing head by relative movement between the dispensing head and the support surface in a second dimension that is different from the first dimension used to connect the cannula array.

31. A liquid handling system as defined in claim 15 further comprising a plurality of pilot rods extending from the plate and engageable with a clamp of the mounting system.

32. A liquid handling system as defined in claim 31 wherein the clamp further comprises clamping rods corresponding in number to the pilot rods and having hinged clamps that releasably engage cap head portions of the pilot rods.

33. A liquid handling system as defined in claim 31 wherein the clamp further comprises clamping rods corresponding in number to the pilot rods, each having a cavity that receives the pilot rods and having locking balls that are driven radially inward by sliding movement of an outer sleeve about the clamping rod to capture the pilot rods in the cavities.

34. A liquid handling system as defined in claim 10 further comprising:

an ejection mechanism configured to separate a cannula array from the dispensing head when the clamp is released.

35. A liquid handling system as defined in claim 34 wherein the ejection mechanism comprises a spring-loaded projection.

36. A liquid handling system having an automatically interchangeable cannula array system comprising:

a dispensing head having robotic elements for movement and dispensing operations,

a quick-release cannula array mounting system having a remotely operable actuator for release and securement of a cannula array and an alignment mechanism,

a controller configured to operate automatically the dispensing head robotics and the mounting system actuator to control release and securement of a cannula array,

first and second cannula arrays, and

a sealing element to maintain a fluid tight seal between the dispensing head and cannula array.

37. A method of automatically changing a cannula array for a liquid handling system comprising:

providing a liquid handling system having a dispensing head with a quick-release cannula array mounting system, a sample support surface configured to support at least first and second cannula arrays wherein the handling system is configured to provide for relative movement between the dispensing head and support surface in at least two dimensions;

moving the dispensing head of the liquid handling system to an area on the support surface;

releasing a first cannula array from the quick-release mounting system;

moving the dispensing head to withdraw the mounting system from the cannula array, leaving the first cannula array on the support surface;

moving the dispensing head to a second cannula array on the support surface and advancing the dispensing head to locate the second cannula array in line with the mounting system of the dispensing head;

actuating the mounting system to secure the second cannula array to the dispensing head;

38. A method of changing a cannula array in an automated liquid handling system as defined in claim 37 wherein each of the steps are controlled by a computer controller operating software customized to include the parameters for the required steps.

39. A method of changing a cannula array on an automated liquid handling system as defined in claim 37 wherein the cannula array is secured in the quick-release mounting system by a clamp that is actuated by the controller.

40. A method of reformatting a first wellplate having a first array format to a second wellplate having a second array format and a third wellplate having a third format comprising:

providing a liquid handling system having a dispensing head with a quick-release cannula array mounting system and a sample support surface and being configured to provide relative movement between the support surface and dispensing head in at least two dimensions, a first cannula array having a first array format, second cannula array having an intermediate array format, and a third array having a large array format,

loading a cannula array having a first array format into the quick-release mounting system

moving the dispensing head to be aligned with a wellplate having a first array format;

aspirating liquid from the first wellplate into the cannula array;

moving the dispensing head to a wellplate having a second array format, positioning the first cannula array into the second wellplate and dispensing the liquid into wells of the wellplate;

repeating the above steps aspirating liquid from other wellplates having a first array format, until the wellplate having a second array format is filled,

automatically exchanging the first cannula array for a second cannula array having a second array format by releasing the first cannula array and moving the dispensing head to the second cannula array and securing it into engagement with the quick release mounting system of the dispensing head;

moving the dispensing head to the second wellplate;

aspirating sample liquid from the second wellplate into the second cannula array;

moving the dispensing head to a third wellplate having a third array format, dispensing a sample liquid from the second cannula array to the third wellplate, then repeating the above steps to fill the wells of the third wellplate from the second cannula array.

41. A method of reformatting a wellplate as defined in claim 40 wherein the first wellplate is configured to have 96 wells, the second wellplate is configured to have 384 wells and the third wellplate is configured to have 1,536 wells.